

The listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1.-24. (Canceled).

25. (Currently Amended) A method of manufacturing a semiconductor device, comprising:

~~heating a substrate by switching on/off a pulsed lamp light source with a cycle of one second or longer~~

heating a substrate by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or longer.

26. (Original) A method according to claim 25, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

27. (Currently Amended) A method of manufacturing a semiconductor device, comprising the steps of:

supplying heated gas into a reaction tube;

~~heating a substrate by switching on/off a pulsed lamp light source with a cycle of one second or longer.~~

heating a substrate by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or longer.

28. (Original) A method according to claim 27, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

29. (Previously Presented) A method of manufacturing a semiconductor device comprising:

disposing a substrate in a reaction tube;

heating the substrate in a first stage by switching on/off a lamp light source in a pulse form with a cycle of one second or shorter, the lamp light source provided outside of the reaction tube; and

heating the substrate in a second stage by switching on/off the lamp light source in a pulse form with a cycle of one second or longer to heat the substrate disposed in the reaction tube.

30. (Original) A method according to claim 29, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

31. (Original) A method of manufacturing a semiconductor device comprising:

disposing a substrate in a reaction tube;

supplying heated gas to the reaction tube;

heating the substrate in a first stage by switching on/off a light source in a pulse form with a cycle of one second or shorter, the light source provided outside of the reaction tube; and

heating the substrate in a second stage by switching on/off the light source in a pulse form with a cycle of one second or longer to heat the substrate disposed in the reaction tube.

32. (Original) A method according to claim 31, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

33. (Currently Amended) A method of manufacturing a semiconductor device, comprising:

disposing a substrate in a reaction tube; and

~~heating the substrate disposed in the reaction tube by switching on/off a pulsed lamp light source with a cycle of one second or shorter.~~

heating a substrate disposed in the reaction tube by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or shorter.

34. (Original) A method according to claim 33, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

35. (Previously Presented) A method of manufacturing a semiconductor device, comprising the steps of:

disposing a substrate in a reaction tube;

supplying heated gas into the reaction tube;

performing a first heat treatment to the substrate disposed in the reaction tube by switching on/off a pulsed lamp light source with a cycle of one second or shorter; and

performing a second heat treatment to the substrate by switching on/off the pulsed lamp light source.

36. (Original) A method according to claim 35, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

37. (Previously Presented) A method of manufacturing a semiconductor device comprising:

disposing a substrate in a reaction tube;

keeping the reaction tube under reduced pressure;

heating the substrate in a first stage by switching on/off a lamp light source in a pulse form with a cycle of one second or shorter, the lamp light source provided outside of the reaction tube;

heating the substrate in a second stage by switching on/off the lamp light source in a pulse form with a cycle of one second or longer.

38. (Original) A method according to claim 37, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

39. (Original) A method of manufacturing a semiconductor device comprising:

disposing a substrate in a reaction tube;

supplying heated gas in the reaction tube while keeping the reaction tube under a reduced pressure;

heating the substrate in a first stage by switching on/off a light source in a pulse form with a cycle of one second or shorter, the light source provided outside of the reaction tube;

heating the substrate in a second stage by switching on/off the light source in a pulse form with a cycle of one second or longer.

40. (Original) A method according to claim 39, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

41. (Currently Amended) A method of manufacturing a semiconductor device, comprising:

disposing a semiconductor film, in which an impurity region of one conductive type is formed, in a reaction tube;

supplying heated gas into the reaction tube; and

~~heating the semiconductor film disposed in the reaction tube by switching on/off a light source provided outside of the reaction tube~~

heating a substrate by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or longer.

42. (Original) A method according to claim 41, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

43. (Currently Amended) A method of manufacturing a semiconductor device, comprising:

disposing a semiconductor film in a reaction tube;

supplying heated gas into the reaction tube; and

~~heating the semiconductor film disposed in the reaction tube by switching on/off a pulsed lamp light source with a cycle of one second or longer.~~

heating a substrate by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or longer.

44. (Original) A method according to claim 43, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

45. (Previously Presented) A method of manufacturing a semiconductor device, comprising:

disposing a semiconductor film, in which an impurity region of one conductivity type is formed, in a reaction tube;

heating the semiconductor film disposed in the reaction tube in a first stage by switching on/off a lamp light source provided outside of the reaction tube in a pulse form with a cycle of one second or shorter; and

heating the semiconductor film in a second stage by switching on/off the lamp light source in a pulse form with a cycle of one second or longer.

46. (Original) A method according to claim 45, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

47. (Original) A method for manufacturing a semiconductor device, comprising:  
disposing a semiconductor film, in which an impurity region of one conductive type is formed, in a reaction tube;

supplying heated gas into the reaction tube;

heating the semiconductor film disposed in the reaction tube in a first stage by switching on/off a light source provided outside of the reaction tube in a pulse form with a cycle of one second or shorter; and

heating the semiconductor film in a second stage by switching on/off the light source in a pulse form with a cycle of one second or longer.

48. (Original) A method according to claim 47, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

49. (Currently Amended) A method for manufacturing a semiconductor device, comprising:

disposing a semiconductor film in a reaction tube;

~~heating the semiconductor film disposed in the reaction tube by switching on/off a pulsed lamp light source provided outside of the reaction tube with a cycle of one second or shorter.~~

heating a substrate by a light from a light lamp source, wherein a light intensity of the light is changed at least two times with a cycle of one second or shorter.

50. (Original) A method according to claim 49, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

51. (Previously Presented) A method for manufacturing a semiconductor device, comprising:

disposing a semiconductor film, in which an impurity region of one conductive type is formed, in a reaction tube;

performing a first heat treatment to the semiconductor film disposed in the reaction tube by switching on/off a pulsed lamp light source provided outside of the reaction tube with a cycle of one second or shorter; and

performing a second heat treatment to the semiconductor film by switching on/off the pulsed lamp light source.

52. (Original) A method according to claim 51, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

53. (Previously Presented) A method of manufacturing a semiconductor device, comprising:

- disposing a semiconductor film, in which an impurity region of one conductive type is formed, in a reaction tube;

- keeping the reaction tube under a reduced pressure;

- heating the semiconductor film disposed in the reaction tube in a first stage by switching on/off a lamp light source provided outside of the reaction tube in a pulse form with a cycle of one second or shorter; and

- heating the semiconductor film in a second stage by switching on/off the lamp light source in a pulse form with a cycle of one second or longer.

54. (Original) A method according to claim 53, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

55. (Original) A method of manufacturing a semiconductor device, comprising:

- disposing a semiconductor film, in which an impurity region of one conductive type is formed, in a reaction tube;

- keeping the reaction tube under a reduced pressure;

- supplying heated gas into the reaction tube; and

- heating the semiconductor film disposed in the reaction tube in a first stage by switching on/off a light source provided outside of the reaction tube in a pulse form with a cycle of one second or shorter; and



heating the semiconductor film in a second stage by switching on/off the lamp light source in a pulse form with a cycle of one second or longer.

56. (Original) A method according to claim 55, wherein the light source is at least one selected from the group consisting of a halogen lamp, a metal halide lamp, a high-pressure mercury lamp, a high-pressure sodium lamp, and a xenon lamp.

57. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a video camera.

58. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a digital camera.

59. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a goggle type display.

60. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a car navigation system.

61. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a sound reproduction device.

62. (Original) A method according to claim 25 wherein the semiconductor device is a personal computer.

63. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a game apparatus.

64. (Withdrawn) A method according to claim 25 wherein the semiconductor device is a portable information terminal.

65. (Withdrawn) A method according to claim 25 wherein the semiconductor device is an image playback device.

66. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a video camera.

67. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a digital camera.

68. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a goggle type display.

69. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a car navigation system.

70. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a sound reproduction device.

71. (Original) A method according to claim 27 wherein the semiconductor device is a personal computer.

72. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a game apparatus.

73. (Withdrawn) A method according to claim 27 wherein the semiconductor device is a portable information terminal.

74. (Withdrawn) A method according to claim 27 wherein the semiconductor device is an image playback device.

75. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a video camera.

76. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a digital camera.

77. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a goggle type display.

78. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a car navigation system.

79. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a sound reproduction device.

80. (Original) A method according to claim 29 wherein the semiconductor device is a personal computer.

81. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a game apparatus.

82. (Withdrawn) A method according to claim 29 wherein the semiconductor device is a portable information terminal.

83. (Withdrawn) A method according to claim 29 wherein the semiconductor device is an image playback device.

84. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a video camera.

85. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a digital camera.

86. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a goggle type display.

87. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a car navigation system.

88. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a sound reproduction device.

89. (Original) A method according to claim 31 wherein the semiconductor device is a personal computer.

90. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a game apparatus.

91. (Withdrawn) A method according to claim 31 wherein the semiconductor device is a portable information terminal.

92. (Withdrawn) A method according to claim 31 wherein the semiconductor device is an image playback device.

93. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a video camera.

94. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a digital camera.

95. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a goggle type display.

96. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a car navigation system.

97. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a sound reproduction device.

98. (Original) A method according to claim 33 wherein the semiconductor device is a personal computer.

99. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a game apparatus.

100. (Withdrawn) A method according to claim 33 wherein the semiconductor device is a portable information terminal.

101. (Withdrawn) A method according to claim 33 wherein the semiconductor device is an image playback device.

102. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a video camera.

103. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a digital camera.

104. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a goggle type display.

105. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a car navigation system.

106. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a sound reproduction device.

107. (Original) A method according to claim 35 wherein the semiconductor device is a personal computer.

108. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a game apparatus.

109. (Withdrawn) A method according to claim 35 wherein the semiconductor device is a portable information terminal.

110. (Withdrawn) A method according to claim 35 wherein the semiconductor device is an image playback device.

111. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a video camera.

112. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a digital camera.

113. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a goggle type display.

114. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a car navigation system.

115. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a sound reproduction device.

116. (Original) A method according to claim 37 wherein the semiconductor device is a personal computer.

117. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a game apparatus.

118. (Withdrawn) A method according to claim 37 wherein the semiconductor device is a portable information terminal.

119. (Withdrawn) A method according to claim 37 wherein the semiconductor device is an image playback device.

120. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a video camera.

121. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a digital camera.

122. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a goggle type display.

123. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a car navigation system.

124. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a sound reproduction device.

125. (Original) A method according to claim 39 wherein the semiconductor device is a personal computer.

126. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a game apparatus.



127. (Withdrawn) A method according to claim 39 wherein the semiconductor device is a portable information terminal.

128. (Withdrawn) A method according to claim 39 wherein the semiconductor device is an image playback device.

129. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a video camera.

130. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a digital camera.

131. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a goggle type display.

132. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a car navigation system.

133. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a sound reproduction device.

134. (Original) A method according to claim 41 wherein the semiconductor device is a personal computer.

135. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a game apparatus.

136. (Withdrawn) A method according to claim 41 wherein the semiconductor device is a portable information terminal.

137. (Withdrawn) A method according to claim 41 wherein the semiconductor device is an image playback device.

138. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a video camera.

139. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a digital camera.

140. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a goggle type display.

141. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a car navigation system.

142. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a sound reproduction device.

143. (Original) A method according to claim 43 wherein the semiconductor device is a personal computer.

144. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a game apparatus.

145. (Withdrawn) A method according to claim 43 wherein the semiconductor device is a portable information terminal.

146. (Withdrawn) A method according to claim 43 wherein the semiconductor device is an image playback device.

147. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a video camera.

148. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a digital camera.

149. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a goggle type display.

150. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a car navigation system.

151. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a sound reproduction device.

152. (Original) A method according to claim 45 wherein the semiconductor device is a personal computer.

153. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a game apparatus.

154. (Withdrawn) A method according to claim 45 wherein the semiconductor device is a portable information terminal.

155. (Withdrawn) A method according to claim 45 wherein the semiconductor device is an image playback device.

156. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a video camera.

157. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a digital camera.

158. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a goggle type display.

159. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a car navigation system.

160. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a sound reproduction device.

161. (Original) A method according to claim 47 wherein the semiconductor device is a personal computer.

162. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a game apparatus.

163. (Withdrawn) A method according to claim 47 wherein the semiconductor device is a portable information terminal.

164. (Withdrawn) A method according to claim 47 wherein the semiconductor device is an image playback device.

165. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a video camera.

166. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a digital camera.

167. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a goggle type display.

168. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a car navigation system.

169. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a sound reproduction device.

170. (Original) A method according to claim 49 wherein the semiconductor device is a personal computer.

171. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a game apparatus.

172. (Withdrawn) A method according to claim 49 wherein the semiconductor device is a portable information terminal.

173. (Withdrawn) A method according to claim 49 wherein the semiconductor device is an image playback device.

174. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a video camera.

175. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a digital camera.

176. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a goggle type display.

177. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a car navigation system.

178. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a sound reproduction device.

179. (Original) A method according to claim 51 wherein the semiconductor device is a personal computer.

180. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a game apparatus.

181. (Withdrawn) A method according to claim 51 wherein the semiconductor device is a portable information terminal.

182. (Withdrawn) A method according to claim 51 wherein the semiconductor device is an image playback device.

183. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a video camera.

184. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a digital camera.

185. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a goggle type display.

186. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a car navigation system.

187. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a sound reproduction device.

188. (Original) A method according to claim 53 wherein the semiconductor device is a personal computer.

189. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a game apparatus.

190. (Withdrawn) A method according to claim 53 wherein the semiconductor device is a portable information terminal.

191. (Withdrawn) A method according to claim 53 wherein the semiconductor device is an image playback device.

192. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a video camera.

193. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a digital camera.

194. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a goggle type display.

195. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a car navigation system.

196. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a sound reproduction device.

197. (Original) A method according to claim 55 wherein the semiconductor device is a personal computer.

198. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a game apparatus.



199. (Withdrawn) A method according to claim 55 wherein the semiconductor device is a portable information terminal.

200. (Withdrawn) A method according to claim 55 wherein the semiconductor device is an image playback device.

201. (Previously Presented) A method for manufacturing a semiconductor device according to claim 27 further comprising:

supplying gas cooled to a temperature equal to or lower than a room temperature into the reaction tube to cool the substrate.

202. (Previously Presented) A method for manufacturing a semiconductor device according to claim 35 further comprising:

supplying gas cooled to a temperature equal to or lower than a room temperature into the reaction tube to cool the substrate.

203. (Previously Presented) A method for manufacturing a semiconductor device according to claim 43 further comprising:

supplying gas cooled to a temperature equal to or lower than a room temperature into the reaction tube to cool the substrate.

204. (Previously Presented) A method for manufacturing a semiconductor device according to claim 51 further comprising:

supplying gas cooled to a temperature equal to or lower than a room temperature into the reaction tube to cool the substrate.

205. (Previously Presented) A method for manufacturing a semiconductor device according to claim 33, wherein the reaction tube is kept under reduced pressure.

206. (Previously Presented) A method for manufacturing a semiconductor device according to claim 35 wherein the reaction tube is kept under reduced pressure.

207. (Previously Presented) A method for manufacturing a semiconductor device according to claim 49, wherein the reaction tube is kept under reduced pressure.

208. (Previously Presented) A method for manufacturing a semiconductor device according to claim 51, wherein the reaction tube is kept under reduced pressure.

209. (Previously Presented) A method for manufacturing a semiconductor device according to claim 25, wherein the substrate is a glass substrate.

210. (Previously Presented) A method for manufacturing a semiconductor device according to claim 27, wherein the substrate is a glass substrate.

211. (Previously Presented) A method for manufacturing a semiconductor device according to claim 33, wherein the substrate is a glass substrate.

212. (Previously Presented) A method for manufacturing a semiconductor device according to claim 35, wherein the substrate is a glass substrate.